Forces and Motion

5-5 The student will demonstrate an understanding of the nature of force and motion. (Physical Science)

5-5.1 Illustrate the effects of force (including magnetism, gravity, and friction) on motion.
Taxonomy level: 2.2-B Understand Conceptual Knowledge

Previous/Future knowledge: In the 1st grade (1-5.2), students explained the importance of pushing and pulling to the motion of an object. In 3rd grade, students explained how the motion of an object is affected by the strength of a push or pull and the mass of the object (3-5.3) and the relationship between the motion of an object and the pull of gravity (3-5.4). In 2nd grade (2-5.2), students explained how the poles of magnets affect each other (that is, they attract and repel one another). In 8th grade, students will analyze the effects of forces (including gravity and friction) on the speed and direction of an object (8-5.3) and predict how varying the amount of force or mass will affect the motion of an object (8-5.4).

It is essential for students to know that a *force* is a push or pull. Forces can make things move faster, slower, stop, or change direction. Different forces (including magnetism, gravity, and friction) can affect motion. -

Magnetism
- A force that acts at a distance and cannot be seen.
- Materials that create this force are said to be magnetic and are called *magnets*.
- The needle of a compass moves because of Earth's *magnetism*.
- When like poles (S-S or N-N) of magnets are near each other, the magnetic force causes the poles to repel, and the magnets push away from each other.
- When opposite poles (N-S or S-N) of magnets are near each other, the magnetic force causes the poles to attract, and the magnets pull toward each other.
- The closer the objects, the greater the magnetic force.
- The magnetic force is greatest at the poles of magnets.

Gravity
- A pull that attracts objects to each other.
- This attraction is not noticeable unless one of the objects is very large, for example a planet, a moon, or the Sun.
- The force of gravity between Earth and anything on it is extremely noticeable because the mass of Earth is so large. The pull of Earth's gravity makes any object fall to the ground.
- As the Moon goes around Earth, its gravity pulls on Earth causing water in the oceans to move toward the Moon.
- Earth's gravity also pulls on the Moon. This force of gravity keeps the Moon moving around Earth.
- Similarly, the pull of the Sun's gravity keeps Earth moving around the Sun.

Friction
- The force that opposes motion between two surfaces that are touching.
- The effect of friction can be observed as an object slides across a surface and slows down.
- The rougher the surfaces are, and the harder the surfaces press together, the more friction there will be.

- Friction can be reduced by using *lubricants*, for example motor oil, wax, or grease, by making surfaces smoother, or by using rollers.
- Friction occurs in liquids and gases as well as between solids.
- Without friction, it would be very hard to slow or stop the motion of objects.

It is not essential for students to know the quantitative relationships involved in forces affecting the motion of objects.

Assessment Guidelines:
The objective of this indicator is to *illustrate* the effects of force on motion; therefore, the primary focus of assessment should be to give or use illustrations, including pictures, diagrams, or word descriptions, of how forces (including magnetism, gravity, and friction) affect the motion of objects. However, appropriate assessments should also require students to *summarize* information about how magnetism, gravity or friction affect the motion of objects; or *recognize* how these forces can affect the motion of objects.